Technical and Professional Education

Curriculum Content Frameworks for Computer Engineering

Curriculum Content Frameworks for Computer Engineering
Developed by the
University of Arkansas at Little Rock

State of Arkansas
Department of Workforce Education

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Preface

The Technical and Professional Education program continues to prepare students for employment and continuing education. To accomplish this preparation, teachers and employers have collaborated to modify individual programs to ensure that instruction is current and comprehensive. This document reflects essential competencies for program completers as well as all aspects of the Computer Systems Industry as required by the Carl D. Perkins Act. The Curriculum Content Frameworks for all Technical and Professional Education programs can be accessed through the Department of Workforce Education Web site.

Foreword

The curriculum content framework *Computer Engineering* supports the course that prepares students for the following career roles, which in turn correspond to the CIP (Classification of Instructional Programs) codes listed below. The courses may be sequenced with a variety of career and technical courses to form a specialization to prepare students for careers and support additional education and training in the computer industry.

Career Family: Information Technology

Career Area: Hardware Support and Services

Career Role CIP Code

Computer Hardware Technology/Technician 151203

Computer Installer and Repairer 470104

O-NET 15-1041.00 Computer Support Specialist

Acknowledgments

The Computer Engineering curriculum content framework was produced by a team of program developers from the University of Arkansas at Little Rock and representatives from industry and education. A panel of experts in the field of Computer Engineering reviewed the framework. The format and content of the framework reflect the specific training needs within the state of Arkansas. The framework content and format is modeled after a document originally developed by a writing team under the auspices of the Virginia Department of Education. Grateful appreciation is expressed to the Virginia Department of Education for granting the Arkansas Department of Workforce Education access to their instructional frameworks.

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Introduction

About the Program

Computer Engineering prepares students for careers in the Computer Systems industry. The course sequence focuses on duties and tasks performed by professionals in Computer Systems installation and repair occupations, as well as pre-employment and employment skills.

About the Document

- Section 1 contains a master duty/task list for the Computer Engineering program.
- Section 2 contains an analysis of each task, consisting of the task, task definition, and process/skill questions to evaluate acceptable performance. All tasks have been designated essential. Essential tasks are those that must be achieved by every student pursuing the completion of the Computer Engineering program.
- Section 3 lists the Arkansas Standards of Learning for language arts, mathematics, and science that are reinforced by instruction in the Computer Engineering program. Academic skills in these areas are necessary for the mastery of a number of tasks performed by computer systems technicians on the job.

Program Description

494400 - Computer Diagnostics

494410 - Computer Operations

494420 - Computer Networking

Computer Engineering prepares students for careers in computer technology. The course sequence focuses on duties and tasks performed by professionals in the computer support field, as well as pre-employment and employment skills.

Students learn to construct, troubleshoot, service, and repair computer systems, related components, and software, and install and maintain local area networks. Completion of this sequence may prepare students for the following certification exams: A+, Certified Computer Service Technician. More information is available from Computer Engineering prepares students

for Comp TIA's A+ Certification examination and the Electronics Technician Association's Computer Service Technician Certification examination. The relationship between Computer Engineering tasks/competencies and certification standards are explained in Related Information Section G.

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Master Duty/Tasks Listing
Computer Engineering
Computer Operations
Computer Diagnostics
Computer Networking

National and state experts in the occupational field of Computer Engineering have validated the duties and tasks in this section. Each is analyzed by identifying the following:

- a *duty*/*task statement*, which describes what the student is to do

DUTY A: **Ensuring Safety**
Task:
A001: Identify various preventive maintenance products and procedures used with computers.
A002: Identify issues, procedures, and products designed to protect people, hardware, and the surrounding workspace within the computer environment.
DUTY B: **Investigating Careers**
Task:
B001: Describe primary responsibilities of a computer systems technician.
B002: Research career opportunities in computer systems technology.
DUTY C: **Using Diagnostic and Troubleshooting Techniques**
Task:
C001: Identify common symptoms and problems associated with various computer components.
C002: Demonstrate basic troubleshooting procedures.

C003: Recognize common PC hardware problems and determine how to resolve them.
C004: Preventing power system failure.
DUTY D: **Configuring a Computer System**
Task:
D001: Identify basic terms, concepts, and functions of computer system components.
D002: Describe the way each computer system component works during normal operation and during the boot process.
D003: Demonstrate basic procedures for adding and removing field-replaceable units for both desktop and portable computer systems.
D004: Identify available IRQs, DMAs, and I/O addresses and procedures for device installation and configuration.
D005: Identify common computer peripheral ports, associated cabling, and their connectors.
D006: Demonstrate procedures for installing and configuring computer IDE/EIDE devices.
D007: Demonstrate procedures for installing and configuring computer SCSI devices.
D008: Demonstrate procedures for installing and configuring computer peripheral devices.
D009: Identify methods of upgrading computer system hardware performance, including procedures for replacing basic subsystem components.

D010: Identify unique computer components and determine criteria for their use.
DUTY E: **Identifying Motherboards, Processors, and Memory**
Task:
E001: Compare popular computer CPU chips in terms of basic characteristics.
E002: Identify the categories of computer RAM by terminology, locations, and physical characteristics.
E003: Identify popular types of computer motherboards, their components, and their architecture.
E004: Identify the purpose of computer CMOS, its settings, and the procedures for changing its basic parameters.
DUTY F: **Demonstrating Knowledge of Operating System Functions**
Task:
F001: Compare computer operating systems in current use in terms of functions, features, and benefits.
F002: Identify the functions, structure, and major system files used to navigate the Windows operating system.
F003: Describe various means of obtaining technical information.
F004: Identify the basic concepts and procedures for creating, viewing, and managing files, directories, and disks.

DUTY G: **Installing and Configuring an Operating System**
Task:
G001: Identify the procedures for installing the operating system and bringing the software to a basic operational level.
G002: Identify the steps to perform an operating system upgrade.
G003: Identify the basic system boot sequences and boot methods, including the steps to create an emergency boot disk with utilities installed.
G004: Identify procedures for loading or adding and configuring application and hardware device drivers.
G005: Identify where to obtain software and resources related to the operating system.
G006: Identify the procedures for installing the network operating system and bringing the network software to a basic operational level.
DUTY H: **Diagnosing and Troubleshooting a PC Operating System**
Task:
H001: Recognize and interpret the meaning of common error codes and startup messages created during the boot sequence.
H002: Demonstrate steps to correct the problems identified by PC error codes and startup messages.
H003: Recognize common PC operating system problems and determine how to resolve them.
DUTY I: **Understanding Basic Network Concepts**

Task:
I001: Identify basic networking concepts, including its operation and the ramifications of repairs on a network.
I002: Identify the functions of a network administrator.
I003: Identify concepts and capabilities related to the Internet and the basic procedures for setting up a system for Internet access.
I004: Identify the functions, features, and benefits of different web browsers.
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J002: Demonstrate steps to correct problems identified by network error codes and startup messages.
J003: Recognize common network problems and determine how to resolve them.
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Task:
K001: Identify basic concepts related to primary printer types, including operation and components. (laser, inkjet, dye sublimation, and dot matrix)
K002: Demonstrate care and service techniques for common problems with primary printer types.

DUTY L: **Examining Computer-Related Security, Privacy, and Ethical Issues**
Task:
L001: Identify and remove viruses, worms, bombs, and Trojan horses.
L002: Examine issues of computer-related business ethics.
L003: Examine issues of copyright ownership and infringement.
L004: Examine issues of computer-related privacy.
L005: Identify functions of a network firewall.
L006: Identify computer security issues.
L007: Identify harassment issues involving computer use.
L008: Identify employer-employee issues of electronic documentation ownership.

Task Definitions
Computer Engineering
Computer Operations
Computer Diagnostics
Computer Networking

National and state experts in the occupational field of Computer Engineering have validated tasks in this section. Each task is analyzed by identifying the following:

- a *task definition* (criteria for acceptable performance), which explains what the student has to do to perform the task at the expected level of mastery
- *process/skill questions*, which assess student knowledge and performance.

Tasks are arranged by instructional duty area only. The placement of tasks into specific courses and the sequencing of tasks for instruction are local decisions based on student needs, employer demand, and school schedules.

DUTY A:
Ensuring Safety

Task:

A001: Identify various preventive maintenance products and procedures used with computers

Definition: Process should include the following:

- review static sprays and ESD straps to prevent electrostatic discharge
- select software programs for Windows maintenance (anti-virus products; security – utilities: defraggers)
- list procedures for safe use of compressed air for cleaning
- develop a schedule for preventive maintenance
- perform a virus scan on a computer system

Process/Skill Questions

- What is the goal of preventive maintenance?
- How frequently should preventive maintenance be performed?
- How can electrostatic discharge be harmful?

A002: Identify issues, procedures, and products designed to protect people, hardware, and the surrounding workspace within the computer environment

Definition: Process should include the following:

- describe ergonomically designed office equipment
- describe the importance of eye protection
- explain how filters design protect against harmful emissions
- review regulations governing equipment disposal
- review proper methods of grounding circuitry
- plan for hardware and software disaster recovery

Process/Skill Questions

- What are some consequences of failure to have properly grounded workstations?
- What are some ethical and legal issues related to computer installation, use, maintenance, and disposal?
- How do disaster recovery plans provide insurance against lost data?

DUTY B:
Investigating Careers

Task:

B001: Describe primary responsibilities of a computer systems technician

Definition: Process should include the following:

- describe responsibilities for installing and maintaining software
- install hardware and connect peripherals
- respond to a service call and document problem and service
- performing routine maintenance on a computer system
- maintain a user group

Process/Skill Questions

- Why is it required that a computer systems technician be able to work with employees at all levels of a company?
- What resources should a computer systems technician consult in order to prepare for computer viruses and other problems?

B002: Research career opportunities in computer systems technology

Definition: Process should include the following:

- use resources such as books, periodicals, and the Internet to learn about the various occupations in computer systems technology
- list the qualifications for a job in the computer industry

Process/Skill Questions

- What are some good resources for learning about career opportunities?
- Why is it necessary to use the most recent resources to learn about all career opportunities in computer systems technology?

DUTY C:
Using Diagnostic and Troubleshooting Techniques

Task:

C001: Identify common symptoms and problems associated with various computer components

Definition: Process should include the following:

- identify problems computer systems technicians commonly encounter with components such as monitor, motherboard, drives, memory, operating system, power supply, processor, case (case design), and adapter boards
- describe problems computer systems technicians commonly encounter with video and graphics cards

Process/Skill Questions

- How should a technician first approach troubleshooting to determine the problem?
- What are some examples of helpful documentation for use when identifying common problems?
- What are some considerations when determining the length of time for resolving the problem?

C002: Demonstrate basic troubleshooting procedures.

Definition: Process should include the following:

- troubleshoot a computer software or hardware problem
- isolate a computer software or hardware problem
- elicit information from a customer complaint
- recognize or interpret error messages and beep codes
- document a computer problem on a work order

Process/Skill Questions

- Why are customer relations skills important?
- What types of questions are successful in eliciting information from the customer?
- Where should you begin your troubleshooting?
- How do you test your solution?

C003: Recognize common PC hardware problems and determine how to resolve them

Definition: Process should include the following:

- recognize PC hardware problems and identify steps to correct them

Process/Skill Questions

- How does a technician learn to recognize common hardware problems?
- What are some sources for instructions for resolving common hardware problems?

C004: Preventing power system failure

Definition: Process should include the following:

- explain the importance of surge protectors
- describe the functions of an Uninterruptible Power Supply (UPS)
- describe recovery procedures after a power system failure
- identify damage that may result from power surges
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Process/Skill Questions

- What damage that can be caused by power failure?
- What measures might an employer take to protect computer data in case of a power failure?

DUTY D:
Configuring a Computer System

Task:

D001: **Identify basic terms, concepts, and functions of computer system components**

Definition: Process should include the following:

- define functions of a monitor, motherboard, storage devices, memory, operating system, power supply, processor, modem, firmware, BIOS, CMOS, ISA, PCI, AGP, AT and ATX, desktop, laptop, PDA, CRT and LCD, serial, parallel, USB, CD, DVD, IDE, SCSI, and IEEE-1384 (Firewire)
- define terms associated with computer system components

Process/Skill Questions

- What is the function of each computer component?
- How important is a common terminology to the success of communicating system issues?
- What is the difference between memory and storage?

D002: **Describe the way each computer system component works during normal operation and during the boot process**

Definition: Process should include the following:

- review power-on self test, including BIOS
- discuss loading of the operating system
- discuss loading of applications software

Process/Skill Questions

- What is the difference between a hard boot and a cold boot?
- What types of error codes might be encountered during the boot process?
- Explain configurations of correct CMOS settings for a successful boot.

D003: **Demonstrate basic procedures for adding and removing field-replaceable units for both desktop and portable computer systems**

Definition: Process should include the following:

- remove and replace field-replaceable units on a desktop computer system
- remove and replace field-replaceable units on a portable computer system
- review manufacturer's guidelines for proper installation of field-replaceable units
- verify correct operation after installing a field-replaceable unit

Process/Skill Questions

- What characteristics of a component make it field-replaceable?
- What components can be replaced in the field, and what must be returned to the factory?
- What must a computer systems technician have in order to replace an inoperable drive?

D004: **Identify available IRQs, DMAs, and I/O addresses and procedures for device installation and configuration**

Definition: Process should include the following:

- define *IRQ* (interrupt request), *DMA* (direct memory access), and *I/O* (input/output) addresses
- install and configure devices and memory addresses
- explain relationships between IRQs, DMAs, I/Os, and their allocated devices
- discuss resource assignment for plug-n-play devices

Process/Skill Questions

- What are some common problems related to IRQs? to DMAs? to I/O addresses?
- What are the consequences of two or more devices sharing the same address?

D005: **Identify common computer peripheral ports, associated cabling, and their connectors**

Definition: Process should include the following:

- identify types of computer ports to include serial, parallel, USB, firewire (IEEE-1394), PS2, DIN, modem, network, and video
- identify cabling and connector types for computer ports

Process/Skill Questions

- What is an example of a peripheral that would use a parallel port?
- What are the benefits of having cabling connectors of varying shapes and sizes?

D006: **Demonstrate procedures for installing and configuring computer IDE/EIDE devices**

Definition: Process should include the following:

- describe functions of IDE/EIDE devices
- review manufacturer's guidelines for proper installation of IDE/EIDE devices
- explain proper jumper settings for IDE/EIDE devices

Process/Skill Questions

- What are some possible consequences of failure to follow the manufacturer's installation guidelines?
- What safety precautions should be taken when installing IDE/EIDE devices?
- How are the proper jumper settings determined for IDE/EIDE devices?

D007: **Demonstrate procedures for installing and configuring computer SCSI devices**

Definition: Process should include the following:

- describe functions of SCSI devices
- outline manufacturer's guidelines for proper installation of SCSI devices
- explain proper jumper settings for SCSI devices

Process/Skill Questions

- What benefits do SCSI interfaces have over standard serial and parallel ports?
- What are methods for ensuring a safe work environment when installing SCSI devices?
- How are proper jumper settings determined for SCSI devices?

D008: **Demonstrate procedures for installing and configuring computer peripheral devices**

Definition: Process should include the following:

- describe functions of peripheral devices
- review manufacturer's guidelines for proper installation of peripheral devices
- review manufacturer's guidelines for loading appropriate software for peripheral devices

Process/Skill Questions

- What are some of the less common peripherals used with computers that technicians must install and configure?
- What are consequences of failure to follow manufacturer's guidelines for proper installation?

D009: **Identify methods of upgrading computer system hardware performance, including procedures for replacing basic subsystem components**

Definition: Process should include the following:

- consider user requirements to determine upgrade needs
- determine system hardware and software upgrade capability
- select correct software and component to upgrade
- install a hardware or software upgrade

Process/Skill Questions

- How do you determine which component to upgrade?
- How do you determine if an upgrade is economically justifiable?

D010: **Identify unique computer components and determine criteria for their use**

Definition: Process should include the following:

- identify components that are considered "cutting edge" technology, latest trends, available to all users, access-increasing (i.e., for special-needs persons)
- determine criteria for unique computer component use including system requirements and needs of user

Process/Skill Questions

- What characteristics of a component classify it as "cutting edge" technology?
- What are some components that increase access for special-needs persons?
- How does a technician determine the needs of the user?

DUTY E:
Identifying Motherboards, Processors, and Memory

Task:

E001: Compare popular computer CPU chips in terms of basic characteristics

Definition: Process should include the following:

- discuss differences between slot and socket
- explain internal and external cache memory
- discuss bus speed
- review history of the processor, showing CPU advancement

Process/Skill Questions

- What is the chronological sequence of CPU advances?
- How does bus speed relate to processing speed?
- What are the differences between internal and external cache memory?

E002: Identify the categories of computer RAM by terminology, locations, and physical characteristics

Definition: Process should include the following:

- identify location (i.e., slot positions) and physical characteristics (e.g., size) of RAM categories to include SIMM, DIMM, RIMM, SDRAM, DDR, EEDO, and Rambus DRAM
- describe the purpose of computer RAM
- describe the characteristics of RAM failure

Process/Skill Questions

- How does the configuration of the motherboard determine locations of RAM?
- What benefits do DIMMs offer over SIMMs?
- How does Rambus DRAM compare with SDRAM?

E003: Identify popular types of computer motherboards, their components, and their architecture

Definition: Process should include the following:

- identify characteristics of motherboards most commonly used in computers today
- identify components that make up the motherboard such as CPU, BIOS, memory, mass storage interfaces, serial and parallel ports, expansion slots, all controllers required to control standard peripheral devices
- describe characteristics of motherboard architecture designs include AT and ATX form factors

Process/Skill Questions

- How does the motherboard relate to the computer system?
- How can a motherboard be modified to increase the speed of the computer?

E004: Identify the purpose of computer CMOS, its settings, and the procedures for changing its basic parameters

Definition: Process should include the following:

- discuss function of CMOS to hold data in memory
- review system requirements that determine CMOS settings
- explain reasons and steps for changing CMOS parameters

Process/Skill Questions

- What is the purpose of the battery in relation to CMOS?
- Why is CMOS attractive for use in battery-powered devices?
- What system characteristics determine CMOS settings?

DUTY F:
Demonstrating Knowledge of Operating System Functions

Task:

F001: Compare computer operating systems in current use in terms of functions, features, and benefits

Definition: Process should include the following:

- discuss advantages and disadvantages of each OS
- associate operating systems with hardware
- differentiate between *open-source* and *proprietary* operating systems

Process/Skill Questions

- What advantages and disadvantages are associated with open-source operating systems?
- How do functional requirements influence the choice of operating system?
- What types of hardware are restricted to particular operating systems?

F002: Identify the functions, structure, and major system files used to navigate the Windows operating system

Definition: Process should include the following:

- list major Windows operating system functions (e.g., creating folders, checking OS version)
- review major Windows operating system components (e.g., Explorer, My Computer, Control Panel)
- contrast features of different versions of Windows
- review location and roles of major operating system files (e.g., system, configuration, and user interface files; memory management)
- explain operating system commands (e.g., sysinfo, regedit, msinfo32)

Process/Skill Questions

- What are the consequences of renaming or deleting system files or folders?
- What are the major differences between Windows XP and earlier versions?
- Why is the regedit command used?

F003: Describe various means of obtaining technical information

Definition: Process should include the following:

- review sources of technical information to include websites, manufacturers' documentation, user groups and discussion forums, installation disks and documentation software, and help menu
- research a technical information question using technical data sources

Process/Skill Questions

- What precautions should be taken when using a discussion forum as a resource for technical information?
- How can updates to manufacturers documentation be obtained?
- When is it appropriate to direct users to documentation?

F004: Identify the basic concepts and procedures for creating, viewing, and managing files, directories, and disks

Definition: Process should include the following:

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Process/Skill Questions

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DUTY G:
Installing and Configuring an Operating System

Task:

G001: Identify the procedures for installing the operating system and bringing the software to a basic operational level

Definition: Process should include the following:

- review starting up, partitioning, formatting the drive, loading drivers, and running appropriate setup utility
- format and partition a hard drive
- install setup utilities from CD or from diskettes

Process/Skill Questions

- What types of drivers must be loaded?
- What are some setup utilities?

G002: Identify the steps to perform an operating system upgrade

Definition: Process should include the following

- upgrade a Windows PC operating system
- replace a Windows operating system

Process/Skill Questions

- What are some problems commonly encountered when performing upgrades?
- What considerations should be made before deciding to upgrade?

G003: Identify the basic system boot sequences and boot methods, including the steps to create an emergency boot disk with utilities installed

Definition: Process should include the following:

- review the boot sequence including startup disk, safe mode, MS-DOS mode, NTLDR, (NT Loader), BOOT.INI
- identify files required to boot in different modes for different operating systems
- create a bootable floppy disk

Process/Skill Questions

- How is the bootable floppy disk used to boot the system?
- What is *safe mode*?
- Why is it important to have a bootable floppy disk?

G004: Identify procedures for loading or adding and configuring application and hardware device drivers

Definition: Process should include the following:

- identify procedures to include Windows 9x Plug and Play and Windows 2000
- identify procedures for installing and launching typical Windows and non-Windows applications
- identify procedures for setting up and configuring the Windows printing subsystem
- install and launch Windows and non-Windows applications
- demonstrate use of Windows Device Manager to identify problem devices

Process/Skill Questions

- What are some typical applications that may be installed?
- Which files provide information about errors encountered during installation of the operating system?

G005: Identify where to obtain software and resources related to the operating system

Definition: Process should include the following:

- lists sources of technical information to include websites, manufacturers' documentation, user groups and discussion forums
- consult operating system installation disks and documentation software for technical information
- access technical information using Internet sources

Process/Skill Questions

- What precautions should be taken when using a discussion forum as a resource for technical information?
- How can updates to manufacturers' documentation be obtained?

G006: Identify the procedures for installing the network operating system and bringing the network software to a basic operational level

Definition: Process should include the following:

- review network start-up procedures
- outline procedure for network drive assignment
- outline the procedure for loading network device driver
- run appropriate network setup utility
- upgrade a Windows network operating system
- create and run a dual boot Windows operating system
- upgrade a network operating system
-

Process/Skill Questions

- What is the procedure for drive assignment?
- What types of drivers must be loaded?
- What are some network setup utilities?

DUTY H:
Diagnosing and Troubleshooting a PC Operating System

Task:

H001: Recognize and interpret the meaning of common error codes and startup messages created during the boot sequence

Definition: Process should include the following:

- interpret PC error messages
- identify steps to correct problems indicated in error messages
- verify problem correction

Process/Skill Questions

- What are some common error messages commonly created during the PC boot sequence?
- What types of problems require reinstalling the PC operating system?

H002: Demonstrate steps to correct the problems identified by PC error codes and startup messages

Definition: Process should include the following:

- elicit problem symptoms from users
- reproduce PC error as part of the diagnostic process
- identify recent changes to the computer environment from the user standpoint
- troubleshoot PC problems

Process/Skill Questions

- What are some methods for eliciting problem symptoms from users?
- Why is it helpful to know about recent changes to the computer environment?
- What are the consequences if the user cannot reproduce the error?

H003: Recognize common PC operating system problems and determine how to resolve them

Definition: Process should include the following:

- recognize PC operating system problems and identify steps to correct them
- describe the sequence for troubleshooting operating system problems

Process/Skill Questions

- How does a student or technician learn to recognize operating system common problems?
- What are some sources for instructions for resolving common operating system problems?

DUTY I:
Understanding Basic Network Concepts

Task:

I001: Identify basic networking concepts, including its operation and the ramifications of repairs on a network

Definition: Process should include the following:

- review concepts such as protocols, sharing disk drives on different operating systems, sharing print and file services, network cards, and configuration of OS for network connection
- identify terms , concepts, and functions of network components
- describe how each network component works during normal operation

Process/Skill Questions

- What effects can network maintenance have on a user's computer?
- What steps must be taken to configure the OS for network connection?
- What are some advantages and disadvantages of sharing disk drives?

I002: Identify the functions of a network administrator

Definition: Process should include the following:

- list responsibilities of a network administrator, including overseeing hardware, software, security, privacy, and ethical issues
- list responsibilities of a network administrator for equipment and software specifications

Process/Skill Questions

- How does the network administrator protect the computer environment from viruses?
- What is the network administrator's role regarding information security?
- What are some privacy issues with which the network administrator may be involved?

I003: Identify concepts and capabilities related to the Internet and the basic procedures for setting up a system for Internet access

Definition: Process should include the following:

- list the advantages of Internet access, including basic Internet concepts and terms, such as ISP, TCP/IP, IPX/SPX, NetBEUI, email, PING.EXE, HTML, HTTP, FTP, domain names, dial-up networking, TRACERT.EXE, and NSLOOKUP.EXE, IPCONFIG, WINIPCFG, DNS, ARP
- describe procedures for setup of a network for Internet access
- identify equipment requirements for Internet access for a network

Process/Skill Questions

- What are the advantages and disadvantages of Internet access?
- What is *HTTP*?
- What does PING.EXE do?

I004: Identify the functions, features, and benefits of different web browsers

Definition: Process should include the following:

- list features, benefits, and other characteristics of web browsers (Internet Explorer, Netscape Communicator, Opera, Mosaic, and Mozilla)
- describe vulnerabilities of various web browsers

Process/Skill Questions

- What issues must a web developer consider when developing web pages to be viewed in a variety of browsers?
- What are advantages and disadvantages of the most common web browsers?

DUTY J:
Diagnosing and Troubleshooting a Network Operating System

Task:

J001: Recognize and interpret the meaning of common network error codes and startup messages created during the boot sequence

Definition: Process should include the following:

- interpret network error messages
- identify steps to correct network problems indicated in error messages
- verify network problem correction

Process/Skill Questions

- What are some common error messages commonly created during the boot sequence?
- What types of problems require reinstalling the operating system?

J002: Demonstrate steps to correct problems identified by network error codes and startup messages

Definition: Process should include the following:

- elicit network problem symptoms from users
- reproduce network error as part of the diagnostic process
- identify recent changes to the computer network environment from the user stand point
- troubleshoot network problems indicated by error codes

Process/Skill Questions

- What are some methods for eliciting problem symptoms from users?
- Why is it helpful to know about recent changes to the computer environment?
- What are the consequences if the user cannot reproduce the error?

J003: Recognize common network problems and determine how to resolve them

Definition: Process should include the following:

- recognize common computer network problems
- distinguish between network hardware and software problems
- identify steps to correct network problems
- demonstrate troubleshooting procedures for network components

Process/Skill Questions

- How does a student or technician learn to recognize common problems?
- What are some sources for instructions for resolving common problems?

DUTY K:
Installing and Configuring Printers

Task:

K001: Identify basic concepts related to primary printer types, including operation and components (laser, inkjet, dye sublimation, and dot matrix)

Definition: Process should include the following:

- compare and contrast various types of printers and identify computer printing concepts
- describe the six steps of laser printing
- discuss the cost-effectiveness of various printing methods
- distinguish between the writing processes of impact, inkjet, and laser printers

Process/Skill Questions

- How do inkjet cartridges (primary colors) work to create colors for prints?
- What is the most cost-effective method of printing? Why?
- What are the six steps of laser printing?

K002: Demonstrate care and service techniques for common problems with primary printer types

Definition: Process should include the following:

- install printer hardware and software
- correct printer connection problems
- replace laser and ink jet cartridges

Process/Skill Questions

- What are some common printer problems?
- What are some methods of correcting connection problems?
- What determines that a print cartridge should be replace?

DUTY L:
Examining Computer-Related Security, Privacy, and Ethical Issues

Task:

L001: Identify and remove viruses, worms, bombs, and Trojan horses

Definition: Process should include the following:

- distinguish among types of viruses
- explain how each type works
- use software to detect viruses
- use software to prevent viruses
- install an updated virus software program
- demonstrate how selected viruses can be erased

Process/Skill Questions

- How frequently should virus software be updated?
- What is the difference between an update and an upgrade?
- What are some reliable sources for learning about the latest viruses?

L002: Examine issues of computer-related business ethics

Definition: Process should include the following:

- interact with customers and supervisors
- use advertising and promotional methods, including web pages in an ethical manner
- discuss discrimination in hiring and workplace environment
- review service and product pricing policies
- describe the use of company resources, such as computers, phones, and fax machines in an appropriate manner

Process/Skill Questions

- What are the ethical issues surrounding interaction with customers?
- How can you help to prevent discrimination in the workplace practices?
- What might be considered inappropriate use of an employer's resources?

L003: Examine issues of copyright ownership and infringement

Definition: Process should include the following:

- explain software licensing agreements
- explain conditions used for licensing agreements
- discuss penalties of using pirated software
- identify differences between freeware, shareware, and copyrighted software
- review rights of the software producer vs. the rights of the customer

Process/Skill Questions

- What are some recent examples of copyright infringement related to the Internet?
- How is freeware developed and marketed?
- How can a company prevent use of pirated software in their computer systems?

L004: Examine issues of computer-related privacy

Definition: Process should include the following:

- explain rights of individuals to privacy related to personal records, conversations, and electronic messages
- explain rights of companies concerning proprietary information
- discuss problems related to stalking on the Internet
- list locations on the web where sensitive information (such as credit card numbers) may be safely divulged

Process/Skill Questions

- What characteristics or practices of a website signify it as a safe place to perform credit card transactions?
- How can the Internet be used as a tool for stalkers?
- What privacy rights does an employee have when using employer's computer equipment?

L005: Identify functions of a network firewall

Definition: Process should include the following:

- explain purpose and characteristics of firewall software
- install firewall software

Process/Skill Questions

- How should threats to the network be evaluated before selecting firewall software?
- What are the advantages and disadvantages of using a firewall?

L006: Identify computer security issues

Definition: Process should include the following:

- list common threats to computer security
- list common threats to computer network security
- identify damage which can result from security breaches
- describe recovery procedures to follow after a security breach

Process/Skill Questions

- What are the most common threats to network security?
- What is SPAM? How does SPAM work? Why is it undesirable? How can it be prevented?
- What are some disadvantages of using filtering software to block access to websites?

L007: Identify harassment issues involving computer use

Definition: Process should include the following:

- discuss methods of computer use that threaten the comfort of employees or users, such as SPAM, chat rooms and stalkers, and threatening email
- discuss ethics and legality of sharing of websites containing inappropriate or illegal content

Process/Skill Questions

- What are some effective methods of dealing with threatening email?
- How might a user feel threatened by the behavior of another user in a chat room?

L008: Identify employer-employee issues of electronic documentation ownership

Definition: Process should include the following:

- discuss issues that arise related to ownership of a document created with employer-owned computer equipment.
- discuss issues that arise related to liability from a document created with employer-owned computer equipment
- describe methods for maintaining electronic records

Process/Skill Questions

- Why is information created with employer-owned equipment the property of the employer?
- What measures might an employer take to ensure the protection of employer-owned information?

General Safety

DUTY : GS (General Safety)
General Safety Practices

Task:

GS001: Follow personal safety guidelines

Definition: Process should include the following:

- identify and comply with personal safety guidelines
- demonstrate understanding of clothing safety guidelines and regulations (hard hat, hard-soled shoes, eye protection, long trousers, shirt with sleeves)
- describe the impact of positive and negative behavior on personal safety
- identify hazards of wearing jewelry while working with tools and equipment

Process/Skill Questions:

- What is the purpose for features of various safety clothing and other safety items?
- What are the steps to identify, report, and correct an unsafe working condition?
- What hazards exist for persons wearing jewelry while working in the laboratory?

GS002: Utilize tools and equipment safely

Definition: Process should include the following:

- identify and use safe working practices for common hand tools found in the industry
- identify and use safe working practices for equipment and power tools found in the industry
- explain and demonstrate safe working practices related to electrical hazards, including lockout/tagout procedures for inoperable tools and equipment
- inspect hand and power tools to ensure proper working condition
- clean and store tools in an organized manner
- demonstrate safe use of ladders
- describe the use of fall-arrest systems

Process/Skill Questions:

- What injuries may occur if a tool is used improperly?
- What items or conditions should be checked to insure that a ladder is setup properly?
- What conditions will cause a tool or piece of equipment to be unsafe?

GS003: Comply with fire and hazardous material guidelines

Definition: Process should include the following:

- identify fire hazards and methods for fire prevention
- identify procedures for fire reporting
- describe methods to extinguish fires
- identify appropriate handling for hazardous material information
- describe appropriate techniques for handling and/or disposing hazardous materials
- demonstrate appropriate measures when handling hazardous materials.
- describe information contained on Material Safety Data Sheets (MSDS)
- Locate and interpret Material Safety Data Sheets

Process/Skill Questions:

- What is the procedure for obtaining information for handling a hazardous material?
- Outline the steps to report a fire within the laboratory area.

GS004: Report injuries

Definition: Process should include the following:

- describe immediate oral reporting of injury to supervisor
- describe procedures to report accident/injury to students or instructor
- describe procedure for a written report of injury, including date, extent of injury, and circumstances

Process/Skill Questions

- What are the necessary steps to report an accident or injury?
- Who should be contacted first in the case of an accident?

GS005: Inspect work place for safe working environment

Definition: Process should include the following:

- inspect ladders, scaffolding, etc. for unstable or improperly erected condition
- identify location of electrocution hazards in the workplace
- describe procedures for removal of job/worksite debris
- describe conditions for properly storing materials
- identify methods to correct hazardous condition
- describe proper methods of storing materials
- identify air quality hazards

Process/Skill Questions

- What conditions cause a ladder to be unsafe?
- What hazards can be caused by worksite debris?

GS006: Report unsafe personal, environmental, and equipment safety hazards

Definition: Process should include the following:

- provide oral safety statements based on observation
- document hazards including date, time, location, and persons involved
- submit written safety report to supervisor

Process/Skill Questions

- What is the procedure for oral reporting of a hazardous condition?
- What type Hazards are possible in the laboratory area?

GS007: Participate in safety training programs

Definition: Process should include the following:

- participate in safety training sessions
- demonstrate knowledge and skills gained from program topics

Process/Skill Questions

- What safety equipment and materials are located in the laboratory area?
- What safety information will help you the most in avoiding injury in the laboratory area?

GS008: Practice safe lifting and carrying procedures

Definition: Process should include the following:

- describe safe lifting and carrying procedures
- identify possible injury resulting from improper lifting and carrying techniques
- demonstrate safe lifting and carrying techniques

Process/Skill Questions

- What injuries are most likely to occur from improper lifting of a heavy object?
- What weight is considered the heaviest that should be lifted with the arms and legs?

SkillsUSA

DUTY A: **Self - Improvement**
Task:
A001: Complete a self-assessment and identify individual learning styles *Definition:* Process should include the following: • Identify and list individual strengths. • Identify and list areas in need of improvement. Process/Skill Questions
A002: Discover self-motivation techniques and establish short-term goals *Definition:* Process should include the following: • Develop a list of short-term goals. • Discuss ways to change or improve lifestyle appearance and behavior. Process/Skill Questions
A003: Determine individual time-management skills *Definition:* Process should include the following: • Prepare and keep a time journal. • Discuss ways to improve time management skills. Process/Skill Questions
A004: Define future occupations *Definition:* Process should include the following: • Search internet for career opportunities within specified fields of study. • Prepare presentation on a specified career area. Process/Skill Questions
A005: Develop awareness of cultural diversity and equity issues *Definition:* Process should include the following: • Research a tradition modeled by individual's family. • Develop personal philosophy statements regarding gender equity. Process/Skill Questions

A006: Define the customer

Definition: Process should include the following:

- Differentiate between External and Internal customers
- Discuss factors which contribute to poor customer relationships.

Process/Skill Questions

A007: Recognize benefits of doing a community service project

Definition: Process should include the following:

- Discuss and list ways to become involved in the community
- Develop a community service project.

Process/Skill Questions

A008: Demonstrate effective communication with others

Definition: Process should include the following:

- Identify and list personal barriers to listening.
- Develop personal plan to overcome barriers to listening.

Process/Skill Questions

A009: Participate in a shadowing activity

Definition: Process should include the following:

- Summarize experience of job shadowing activity.

Process/Skill Questions

A010: Identify the components of an employment portfolio

Definition: Process should include the following:

- Identify parts of a portfolio
- Design a personal employment portfolio

Process/Skill Questions

A011: List proficiency in program competencies

Definition: Process should include the following:

- Complete an interpersonal competency assessment.

Process/Skill Questions

DUTY B:
Civic, Social and Business Awareness

Task:

B001: Measure/modify short-term goals

Definition: Process should include the following:
- Discuss steps to pursue short-term goal(s)

Process/Skill Questions

B002: Identify stress sources

Definition: Process should include the following:
- List personal sources of stress.
- Discuss techniques to cope with individual sources of stress.

Process/Skill Questions

B003: Select characteristics of a positive image

Definition: Process should include the following:
- Discuss actions and traits that lead to a positive image.
- Discuss actions and traits that lead to a negative image.

Process/Skill Questions

B004: Demonstrate awareness of government, professional organizations and trade unions

Definition: Process should include the following:
- Identify state governor, legislators, and senators.
- Identify professional organizations pertaining to specific career areas.

Process/Skill Questions

B005: Apply team skills to a group project

Definition: Process should include the following:
- Form a team to develop a class project.

Process/Skill Questions

B006: Observe and critique a meeting

Definition: Process should include the following:
- Attend a formal meeting held within the community
- Critique the attended meeting.

Process/Skill Questions

B007: Demonstrate business meeting skills

Definition: Process should include the following:
- List and discuss the basic rules to ensure an orderly and business-like meeting

- Role-play appropriate meeting skills

Process/Skill Questions

B008: Demonstrate social etiquette

Definition: Process should include the following:
- Role-play appropriate social behavior
- Differentiate between good and bad manners.

Process/Skill Questions

B009: Complete survey for employment opportunities

Definition: Process should include the following:
- Gather information on a particular employment opportunity of interest.
- Conduct internet search of a specific career area.

Process/Skill Questions

B010: Review a professional journal and develop a 3 to 5 minute presentation

Definition: Process should include the following:
- Develop a presentation on the content, purpose, and distribution of a particular professional journal

Process/Skill Questions

B011: Identify customer expectations

Definition: Process should include the following:
- List and discuss customer expectations.
- Discuss consequences of unmet customer expectations.

Process/Skill Questions

B012: Complete a job application

Definition: Process should include the following:
- Obtain a job application from various businesses in the community
- Conduct a mock job interview.

Process/Skill Questions

B013: Identify a mentor

Definition: Process should include the following:
- Define mentor.
- Discuss ways in which a mentor can help an individual meet career goals.

Process/Skill Questions

B014: Assemble your employment portfolio

Definition: Process should include the following:

- Develop employment portfolio

Process/Skill Questions

B015: Explore supervisory and management roles in an organization

Definition: Process should include the following:

- Examine an organizational chart
- Discuss responsibilities of managers and supervisors

Process/Skill Questions

B016: Recognize safety issues

Definition: Process should include the following:

- Discuss safety issues within a given career area

Process/Skill Questions

B017: Evaluate your proficiency in program competencies

Definition: Process should include the following:

- Define task and competency
- List competencies associated with a specified career area.

Process/Skill Questions

Technical And Professional Curriculum Frameworks

Purpose

This section of the framework contains material to help instructors in technical and professional programs to reinforce basic skills in the areas of Reading and Writing, Math and Science. The technical portion of this guide takes a more direct approach by using specific duty and task listings, but changes in the academic section lead in a more general direction. The reason for this is simple: all good instructors do not teach in the same way. However, all good instructors share the trait of being able to connect their material to everyday life. For example, understanding concepts related to heat, are important for cosmetology students as well as lathe operators in manufacturing plants. However, each program will probably take a different approach in the amount of detail and examples relating to heat concepts. Both groups require basic science knowledge of principles relating to heat, but the application of the principles will be different.

Basic Skills: The Content Areas

Included in this guide are materials to support basic skills in Reading and Writing, Mathematics, and Science. The overall approach taken here is a move toward problem-solving skills. By problem-solving, we mean the ability to take information and use it for a purpose: to take action, make decisions, predict outcomes, suggest improvements. Another term for these thinking skills is a general "literacy."

Literacy skills have always been in demand in the workplace. A quick review of workplace training programs and other literature regarding adult education demonstrates that the need for a literate workforce is still one of the most pressing problems employers face today. Indeed, many employers (from small- and medium-sized businesses to Fortune 500 companies) have spent hundreds of millions of dollars on in-house basic skills training programs.

What constitutes a literate workforce? There are many definitions for literacy and hundreds of tests that measure it, but when employers are asked what they're looking for in potential new hires, the answers are general: they want individuals who can read and write; show up on time; think and solve problems, and keep their personal lives in order (that is, don't bring a drinking problem into the workplace).

Viewed in this way, the words "literacy" and "literate" are good terms for what educators are trying to instill in their students, the future workforce. The more common definition (being able to read and write) is certainly appropriate but the additional definitions (knowledgeable, educated, well-informed) are also apt. It is this broad term, "literate," that we use to guide instructors on what to cover in the classroom. No matter which Professional and Technical area is being focused on, no matter how technical the terminology is, instructors are given the task of helping students take information, break it down into necessary parts, process details, and be able to come away with an understanding of some sort. This is "literacy", and the process is the same for every subject area-- teaching students how to think and solve problems.

Format

Each section includes a two-column table. Skills are listed on the left side; suggestions for implementing these skills into the curriculum are listed on the right side. Each suggestion is written in such a way that it can be tailored to most Professional and Technical programs.

Using The Guide

This guide was prepared with four concepts in mind:

- The instructor is *aware of the need* for students to improve their basic skills.
- The instructor is the *best-qualified person* to decide how to include this material in the classroom or lab. The students' abilities and needs should drive the instructor in deciding how to use, expand, or modify these topics.
- The instructor *already has curriculum that works* for his or her students. Therefore, the suggestions for reinforcing basic skills
    - must be easy to implement
    - must stand alone

- do not need to be taught in a particular order
- must be open-ended enough to be useful for any Professional and Technical program.

- ***Time is limited.*** Unless there are quick ways to reinforce basic skills, changes to the curriculum will not be made. Teaching basic skills in the context of technical material will help students make connections that are more memorable, and will require no additional lesson planning. Just as instructors incorporate updates in technical knowledge, they can add basic skills concepts as well. Adding a few concepts at a time will help students perform better in the lab as well as on tests and evaluations.

Methods

The following methods may help instructors decide how to increase basic skill knowledge:

- *Collaborative projects*- how could a joint project between regular education teachers and Professional and Technical instructors reinforce concepts for both programs?
- *Outside assignments*- would students benefit from an outside assignment explaining how a basic math (science, reading) concept ties to a process in the lab?
- *Extra credit*- students needing extra credit can research outside topics and turn in a short summary of material
- "*Need-to-know" assignments*- Students prepare a bulleted list of the basic concepts in science they need to know in order to correctly perform ____ operation in the lab.
- *Question of the Day*- a few daily math problems for students to answer at the beginning of class allows the instructor to set the tone for the material. It also gives students an immediate goal when they enter the classroom and teaches them to stay on task. Bonus points may be awarded at the end of the week, quarter, semester, etc.
- *Two-minute Oral Presentations*- students who need to practice speaking skills can be asked to give a two-minute oral presentation at the end of class summarizing the main points for the day. Or, a two-minute presentation at the beginning of class can recap the material from a previous class.
- *Connecting with Workers*- students can poll parents, friends, area employers or other persons to find out the top 5 basic science skills needed on the job.

- *Direct Questioning*- include a few basic knowledge questions in a presentation. Award points to groups based on correct answers.

Resources

In creating the Academic Reinforcement material for the technical and professional frameworks, we used a number of source documents and resources.

- The English Language Arts, Science, and Mathematics components of the *Curriculum Improvement Project* by Dr. Willard Daggett were consulted to ensure that the top-ranked skills in those areas would be reflected in the academic support material. The English Language Arts and Science components have many linkages to the material included here. (The higher-level math skills such as trigonometry were not included in this document.)
- Data from work with Arkansas employers- the Workplace Skills Enhancement Program (WSEP) at the University of Arkansas at Little Rock (UALR) has completed many training projects and job profiles for employers in Arkansas. Our constant contact with workers and employers provides a tremendous amount of data that we use in designing customized training programs and in working on projects such as curriculum frameworks. Also, the staff of WSEP has experience teaching in Arkansas public schools, the US military, and the Job Corps.
- Additionally, other groups within UALR (the Labor Education Program, the Institute for Economic Advancement and the College of Business) provide resources regarding health and safety information, labor unions and their role in the workplace, computer and information technology and other training and outreach program data.
- US Department of Labor- the US DOL has many online documents and publications that support workers and issues regarding the workplace. (Work by Philippi and Greenan, 1988 on workplace skills was especially helpful.) Visit the website at www.dol.gov.
- Occupational Safety and Health Administration (OSHA) provides online and other resources for instructors and professionals. For topics relating to safety and health, visit www.osha.gov.

- Multistate Academic and Vocational Curriculum Consortium (MAVCC) is an organization that develops competency-based curriculum. For more on MAVCC see www.mavcc.org.

ACADEMIC STANDARDS FOR READING AND WRITING

Strategies for Reinforcement in the Career and Technical Classroom

Note:
*** indicates industry-related materials, handouts, notes, etc.**

Objective	**Classroom Applications to Industry**
Present, *Review and Discuss,* *Master* **the list of skills employers want for the workplace regarding reading and writing.**	Use the list of skills employers want to introduce students to the requirements of the workplace. Depending on students' ability levels, any of the following methods may be used to increase their understanding of the concepts: • Discussion • Interviewing parents or other adults in the workplace about the skills required • Interviewing employers about the skills in terms of importance • Identifying workplace situations in which certain skills become more important than others • Researching adult education programs to learn why deficits in these areas must be remediated, and the cost spent yearly on these programs • Researching the topic of adult literacy
Answer **simple comprehension or recall questions from a lecture or from written material.**	Provide 2 examples of workplace materials* on students' reading level. With the first, allow students to read information and then answer brief recall questions. With the second example, read aloud the material but do not give a handout. Ask brief recall questions. Compare the differences…how do students retain information better—orally or visually? Discuss learning styles and impact on the job.
Follow, *Give* **oral instructions.**	Using instructions for a hands-on task, have students give <u>oral</u> instructions to a partner or group. Rate the effectiveness of the speaker.

Follow, *Give* **written instructions.**	Using a short list of instructions for a hands-on task, have students give written instructions to a partner or group. Rate the effectiveness of the speaker.
Show **the difference between relevant and irrelevant details.**	Using a copy of workplace materials*, students underline relevant or important details in red, irrelevant or less important details in blue.
Sort **objects based on x number of criteria.**	Using workplace materials*, sort a group of objects based on characteristics identified by instructor (e.g., by color, shape, defect, or a combination of these).
Recognize, *Identify* **technical vocabulary.**	Using workplace materials*, highlight technical vocabulary terms. Create a class dictionary of industry-related technical vocabulary. Students may add illustrations or diagrams. Each student receives a copy of the final product. Emphasize skills such as alphabetical order, guidewords, prefixes, suffixes, and pronunciation guides.
Read **aloud.**	Read aloud from workplace materials* in groups or individually.
Identify, *Explain* **symbols, abbreviations and acronyms relevant to subject area.**	Using workplace materials*, highlight symbols, abbreviations, and acronyms. Create a table with one column for each of symbols, abbreviations, acronyms. Classify each one and write in the meaning.
Understand, *Use* **rules of grammar, usage, spelling, punctuation.**	Identify the missing punctuation mark, misspelled word, incorrect use of grammar from workplace materials*. Correct the mistakes.
Discuss **uses and purposes of a variety of workplace communication tools.**	Find examples of a business letter, memo, report, brochure, proposal, schematic, map, and diagram.
Duplicate **process demo by instructor**	Using a workplace process, demonstrate steps

	to complete and have students perform individually or in groups.
Notice, *Apply* **word analysis techniques.**	Using workplace materials*, identify prefixes, suffixes, or roots that indicate meaning (e.g. therma = heat) [1]
Match **parts from photographs or diagrams to actual objects.**	Using workplace materials*, follow a sequence of pictures or diagrams to build, create, or copy an item or process.
Read **for main ideas and for details.**	Use a graphic organizer[1] to show main ideas and supporting details.
Distinguish **between fact, opinion, and inference.**	Collect examples of materials based on fact or opinion/inference. Ask students to underline key terms that indicate the presence of facts or opinions.
Distinguish **between rows and columns;** *identify* **a cell as a block where a row and column intersect.**	Using charts or tables from workplace materials*, discuss the reasons for this format. Identify the quantity in a particular cell.
Select, *Use* **appropriate resources and reference tools.**	Explain the uses for the following: Dictionary, Thesaurus, Almanac, Atlas, Card Catalog, Encyclopedia. List reasons for choosing one reference tool over another. Use reference tools to answer questions related to industry or current events.
Paraphrase **written or oral material into summary form.**	Using workplace materials*, determine the best way to condense or shorten the material so as to give an overview to a layperson. Using a set of guidelines appropriate to students' level in length and detail, summarize the information into bullet points.

Interpret, *Fill out/complete* **forms and records.**	Using workplace materials*, answer basic questions (e.g., summarize the list of parts from an inventory). Using blank forms or documents, fill in details. Pay close attention to directions. Students critique work with partner. Create a form or document to be used in a workplace process.
Use, *Develop* **a process for remembering details.**	Use pneumatic devices to organize and remember details. Pneumatic devices[1] include Semantic Maps, Thought Webs, and other creative tools to organize thinking.
Proofread, *Correct* **mistakes in written drafts.**	Using a newspaper article, locate and mark mistakes in grammar, punctuation, or usage. Correct mistakes in written drafts.
Examine **different types of writing used in the workplace (reports, memos, brochures, logs, blueprints, formulas, etc).**	Gather samples of workplace materials*. Identify each by type. Compare and contrast the difference between audience, (who the document is written for) length, background information/education needed to understand material, level of detail, organization and layout of the document.
Understand **the writing process.**	In order to apply the writing process, create a workplace communication tool to be used for a specific purpose. Prewrite: Brainstorm, gather facts, or do research to create a business letter, memo, report, brochure, proposal, schematic, map, or diagram. Identify the audience.

	Determine the purpose of the document. Write: Create a first draft. Revise and Edit: Make changes to ensure accuracy. Look at the writing from a different point of view. Shorten or make more concise where possible. Use white space, bold print and other formatting details to make the document easy-to-read. Publish: Decide on the best format for the final copy (size, type of material, layout, graphics, etc.) Publish the final draft.

Identify, *Create* **sentences of different types.**	Using workplace materials*, find sentences of varying types. Examples include Simple Sentences (subject + predicate) Complex Sentences (subject + predicate including clauses). Write sentences, paragraphs, or essays using sentences of different types (e.g., write a 2-paragraph summary of today's lesson).
Identify, *Use* **contractions correctly.**	Using workplace materials*, locate contractions (e.g., isn't, I'll). Identify misuses of contractions. Write a short list of directions relating to an industry process and use as many contractions as possible.
Identify, *Use correctly* **commonly misspelled words.**	Using a list of commonly misspelled words[1], locate errors in the media (newspaper articles, Internet sites, magazines.) Ask each student to identify his problem words from the list. Attempt to incorporate problem words into class activities (e.g., add them to a list of work instructions). Give short weekly quizzes focusing on 5 words per week. Award bonus points.
Identify, *Use* **correctly the English irregular verbs.**	From a list of irregular verbs, review the uses of each. Ask each student to identify his problem irregular verbs from the list. Attempt to incorporate problem verbs into class activities, such as making a collection of mistakes from print.
Identify, *Use* **Signal Words and other cues to improve writing.**	Use a list of Signal Words[1] and discuss their purpose in writing (signal words are words that raise a flag to a reader to pay attention.)

	Examples: Signal Words sowing emphasis: Most of all, It should be noted, Of course Signal Words showing a conclusion: Lastly, In summary, Finally Identify common signal words in workplace writing, especially in sequenced lists. Write a list of work instructions using signal words.
Identify **components of workplace documents such as blueprints, schematics, floor plans, and other industry-related documents.**	Label the parts of a workplace document.
Place **steps in proper sequence.**	Using a list of steps or pictures cut them apart so that students can place them in the proper order.
Analyze **cause and effect.**	Experiment with cause and effect in the classroom (e.g., change the sequence of events in a process).
Determine **missing information.**	Locate the information that is missing from a problem and explain why the problem cannot be solved without it. To reinforce concepts, use a completed problem and remove the important details. Ask students if they can identify what's missing.
Differentiate **between tools used for a job.**	Given a list of tools and a list of functions, identify the most efficient tool for each task.
Assemble **or disassemble objects.**	From a list of oral or written instructions, assemble an object or complete a process. Students write the instructions for disassembly.
Cross-reference **materials to compare information.**	Using more than one source document, compare the information given.

Interpret **reasoning behind rules or regulations.**	Using workplace materials*, make a list of possible reasons or justifications for a safety guideline, regulation, etc.
Show contrasts **between approaches.**	Given a workplace scenario, write a brief approach to solving the problem. (Working in groups would be beneficial.) Compare and contrast each approach from the perspective of a worker, manager, supervisor.
Organize **data in a new format.**	Using workplace materials*, organize the information into a new format.
Prove **a rule or method's sufficiency.**	Perform an experiment to determine how much tolerance is acceptable in a case study, (e.g., find the range of drops of red dye sufficient to match the standard red color used in latex paint).
Show **relationships between two or more systems.**	Using 2 or more partners related to industry, show or explain how they are interrelated (e.g., explain the relationship between social workers and hospitals).
Given examples of emergency situations, *identify* **real world course of action.**	Using an emergency situation common to your industry, outline a step-by-step plan for action.
Identify **variables that affect the outcome of a process.**	Experiment with or predict variables that affect the outcomes for a process (e.g., weather patterns that adversely affect a process, such as building a road).
Infer **situations that meet guidelines when complete information is not available.**	Given a policy or industry standard that has debatable interpretations, list possible situations that can arise that do not have clear solutions in the policy. Discuss or debate the issues.
Compare **finished products to a set of guidelines.**	Compare a set of objects to a set of guidelines (e.g., analyze a batch of parts and document how they do or do not meet a set of Quality Assurance guidelines).

	List any discrepancies (parts that do not meet guidelines) and categorize them by type (e.g., burns, holes, etc).
Identify **preventative measures for maintenance of a system.**	List the needed routine maintenance to keep a system working properly.
Predict **new standards or rules that may become necessary in the future.**	Identify recent areas of change or development in your industry. Discuss potential future needs or developments that may occur (e.g., potential need for better training requirements for airport personnel).
Improve **a process by streamlining (locating waste) or decreasing lost time.**	Examine a process in industry in step-by-step detail. Suggest ways to decrease time needed or make the process more efficient. Isolate the cause of failure in a process by performing an experiment.
Prepare **a model explaining a concept.**	Build, draw, or create a model that explains a concept (e.g., show a need for environmental standards for water or air pollution).

[1] Fry, Edward; Kress, Jacqueline; Fountoukidis, Dona. *Reading Teacher's Book of Lists,* 4th ed. ISBN 0-13-028185-9.

ACADEMIC STANDARDS FOR MATHEMATICS

Strategies for Reinforcement in the Career and Technical Classroom

Note:
*** indicates industry-related materials, handouts, notes, etc.**

Topics Listing
Problem Solving
Operations and Calculations
Applications
Data Analysis and Display

Objectives	**Classroom Applications to Industry**
Present *Review and Discuss* *Master* **the list of skills employers want for the workplace regarding mathematics.**	Use the list of skills employers want to introduce students to the requirements of the workplace. Depending on students' ability levels, any of the following methods may be used to increase their understanding of the concepts: • Discussion • Interviewing parents or other adults in the workplace about the skills required • Interviewing employers about the skills in terms of importance • Identifying workplace situations in which certain skills become more important than others • Researching adult education programs to learn why deficits in these areas must be remediated, and the cost spent yearly on these programs • Researching the topic of adult literacy
PROBLEM SOLVING	
Examine ***Apply*** **problem**-solving process.	Define the problem What is being asked? Decide on a type of solution Multi-step or single-step question? Try any of these: Estimate an answer Draw a diagram Find a pattern

	Guess and check Logical Reasoning Make a graph Make an organized list Make a table Solve a simpler problem Use a simulation Work backwards Write an equation Locate information you need Do you have all the components? Get missing information May need to perform some other calculations Calculate Look at the answer. How should the remainder be expressed? Check the solution Is it reasonable?
OPERATIONS AND CALCULATIONS	
Read, write, **and** *count* **numbers.**	Read and write numbers (especially focus on very large and very small numbers where mistakes are common). Give a weekly quiz asking students to compare and sequence numbers. Example: 0.4445 ___ 0.4455 > or < Put these in order from smallest to largest: 0.66, 0.677, 0.67
Round **numbers.**	Discuss your industry's use of decimals. Identify the place values needed to adequately perform a job. For example, a Quality Assurance Technician who works on the line in a manufacturing plant may need to use numbers through the ten-thousandths decimal place.

	Take a series of sample measurements, and round them to the nearest decimal place identified by the instructor.
Estimate **numbers.**	The skill of making close estimations is tied to understanding accuracy. Discuss real-life situations where estimation is used. Discuss the practice of estimation before calculation. Regular practice in estimating before calculating will teach students where they make errors and will increase their estimation skills. Discuss work situations where estimation skills are required, and possible consequences of making estimation errors (for example, is an estimate appropriate for inventory purposes? For ordering supplies?)
Compute **averages.**	Discuss averages in general terms. Calculate the average temperature, average rainfall or precipitation, average number of students per class, and other relevant examples. Using workplace materials*, calculate a series of averages. For example: • Take 10 different measurements of a piece of pipe using a micrometer. • Compare the measurements. • Find the average of all the measurements. • Compare the average to the smallest and largest measurement. • Discuss the effects on quality…when is an average an acceptable benchmark measurement?
Calculate **with whole numbers: perform one-step problems with basic operations.**	Understand, at a level of complexity appropriate to your industry and to students' ability levels, basic principles of addition, subtraction, multiplication, and division.
Perform **problems that require an**	Using workplace materials*, make a list of

understanding of the order of operations.	situations or problems that need more than one step to perform them. If the procedures (add, subtract, multiply, divide, etc) are on the same level of importance, such as adding or subtracting, then the order of operations will not impact the way the problem is solved. If a problem requires more than one level of operation to solve (example, dividing and adding), work the problem correctly by performing the division part first and then the addition. Rework the problem using addition first. Compare the answers. Discuss the importance of reasoning skills to verify that an answer makes sense.
Understand **the relationship between decimals, fractions and percents.**	Make a table comparing fractions, decimals, and percents.
Compute **with fractions, decimals, and percents, and show understanding of the relationship between them.**	Create sample problems using fractions that relate to everyday situations. ▪ Poll the class on interesting topics (favorite food). Convert whole numbers to fractions. Votes- Pizza- 10 Salad- 2 BBQ- 8 10+2+8 = 20 (recognize denominator value) $\frac{10}{20}$ Pizza $\frac{2}{20}$ Salad $\frac{8}{20}$ BBQ ▪ Add the fractions. $\frac{10}{20} + \frac{2}{20} + \frac{8}{20} = \frac{20}{20}$ ▪ Convert fraction to whole number. (Total answers equal 1 class's worth of answers.)

	$\frac{10}{20} + \frac{2}{20} + \frac{8}{20} = \frac{20}{20} = 1$ ▪ Convert fractions to percents. $\frac{10}{20}$ means 10 divided by 20 = 0.50 Move decimal 2 places right. 0.50 = 50% $\frac{2}{20}$ means 2 divided by 20 = 0.10 0.10 = 10% $\frac{8}{20}$ means 8 divided by 20 = 0.40 0.40 = 40% 50% + 10% + 40% = 100% Notice the totals add to 100%. So, $\frac{20}{20} = 1 = 100\%$ Using workplace materials*, calculate work-related questions using fractions, decimals, and percents. Calculate shipping costs for internet purchases (such as music from amazon.com).
Solve **formulas and equations.**	Understand, at a level of complexity appropriate to your industry and to students' ability levels, basic principles of equations. ▪ Work left to right ▪ Use order of operations ▪ Place numbers on one side, variables on the other side
Obtain **squares and square roots.**	Review the methods for calculating squares, square roots, cubes, and cube roots. Use industry-related formulas to demonstrate examples. Compare the difference between the 2 common answers to 3^2 (answer = 9, not 6).

	How would an incorrect value affect the work on the job?
Convert units of measure: *Recognize* **components of measuring systems (US and metric) for length.**	Discuss industry measures and terms relating to length.
Convert units of measure: *Recognize* **components of measuring systems (US and metric) for mass/weight.**	Discuss industry measures and terms relating to mass/weight.
Convert units of measure: *Recognize* **components of measuring systems (US and metric) for volume.**	Discuss industry measures and terms relating to volume.
Measure **with a certain degree of accuracy.**	Estimate measurements. Using workplace materials* and tools, take measurements of work-related and classroom items. Depending on ability level, students may measure to the nearest foot, inch, centimeter, etc.
APPLICATIONS	
Solve **word problems.**	Help students feel more comfortable with word problems by placing simpler problems in word problem form; or take concepts students have already mastered and ask them to write word problems for each other to solve.
Select/apply **mathematical formula.**	Review a set of math formulas and then a list of sample problems. Decide which formula(s) apply to each problem.
Understand **the importance of time in the workplace.**	Using workplace materials*, make a list of workplace scenarios that require using time correctly, such as keeping a time card, or heating a liquid solution for 20 minutes.
Recognize **components of time systems (clocks and calendars).**	AM and PM Leap Year Military time

Discuss, *Identify,* *Understand* **terms relating to measuring time.**	Discuss the units of time measurement and time vocabulary: second, minute, hour, day, week, month, year, leap year, fiscal year, quarter, annual, biannual, etc.
Understand **that time can be expressed in terms of equivalencies.**	Show the time equivalencies using fractions. For example: 1 ½ days = ___ hours 1 day = 24 hours + ½ day = +12 hours 1 ½ days = 36 hours
Compute **time conversions.**	Make a table that shows the equivalencies of time units. Compute conversion problems at the appropriate level of difficulty. Examples include: • Convert minutes to hours • Convert hours to days • Convert seconds to years.
Calculate **ratio and proportion.**	Review fractions when discussing ratio and proportion. Draw common classroom items to scale by finding a conversion rate (1 foot equals 1 inch). Make predictions using ratios. (If each student in class has 3 children, how many children will there be all together? Write the ratios.)
Apply **geometry principles: Use formulas for measuring shapes of 2 dimensions.**	Determine the formulas that apply to 2 dimensions: perimeter, area, surface area, etc. Find perimeter of classroom. Discuss perimeter of objects that are not shaped as perfect squares. How does this change the formula for perimeter? Find the area of the tiles on the floor. Find the area of the classroom.

	Review that all areas are expressed in terms of square units (square inches, square miles, etc)
Apply **geometry principles: Use formulas for measuring shapes of 3 dimensions.**	Review the formulas that apply to 3 dimensions of objects: volume. Find the volume of common objects such as soda cans, pizza boxes, etc. Review that volume is expressed in cubic units. Discuss industry-specific needs for these formulas; for example, find the volume of a tank or silo.
Define **terms relating to money.**	Understand, at a level of complexity appropriate to your industry and to students' ability levels, basic principles relating to money. For more advanced students, include terms and principles of economics, finance, or statistics.
Perform **one-step problems involving money.**	Make change. Count up (rather than backwards) to make change.
Perform **multiple-step problems using money.**	Calculate gross and net earnings. Calculate ▪ Interest ▪ Sales tax ▪ Percent off ▪ Sale price ▪ Profit percentages Perform banking transactions.
Perform **business-related financial activities.**	At a level of complexity appropriate to your industry and to students' ability levels, solve income/expense problems, prepare budgets, etc.
Use **a calculator to perform computations.**	Identify appropriate activities that can be performed using a calculator (calculators

	allow students to concentrate on problem-solving strategies. Award prizes for weekly activities or competitions.
Calculate **measurements taken from measuring devices.**	Add, subtract, multiply and divide measurement numbers by plugging them into formulas.
Perform/prepare **an inventory.**	Use a sample group of items to prepare an inventory. Review inventory vocabulary terms. Discuss the math processes that would apply to the inventory process.
DATA ANALYSIS AND DISPLAY	
Recognize **types of visual representations.**	Charts Graphs Tables
Interpret **charts, graphs and tables.**	Answer simple questions about charts, graphs and tables. *Solve* multi-step problems involving the correlation of graphs and tables.
Collect/record **data.**	As appropriate to industry, practice sampling methods. Discuss safety precautions for sampling. Visit OSHA at the Department of Labor website for more details. Practice collecting and recording sample data from your industry (such as measurements taken using a micrometer). Compare class answers. Find the range of answers (maximum and minimum). Find the average. Discuss an acceptable range of answers (±), and graph the results showing the number that fell inside and outside the acceptable range.

*Review **and** apply* **principles of probability.**	Use real-life examples that are highly motivating to direct the students' attention to probability principles. (Example, "I am thinking of a number between 1 and 50. The person who guesses the number will receive that many bonus points if she can tell me the probability of choosing the number correctly.")
Use probability models to *predict* **chance events.**	Calculate theoretical probability of an event (e.g., the probability of rolling a 5 on a die is 1/6). Find empirical probability of an event by performing repeated experiments. Compare the 2 probabilities.
*Calculate **and** interpret* **statistics.**	Identify the importance of using statistics correctly. Bring examples of statistics from the news or media and analyze them: are they ambiguous? Are they correct? What data is the advertisement trying to get the public to see? For a humorous look at statistics, see *How to Lie with Statistics* by Huff and Geis.
Interpret **plans/blueprints.**	Review vocabulary and terms for plans, blueprints and schematics. Build a plan or blueprint one layer at a time, starting with the basic identifying information. Add layers of wax paper or other transparent drawing material on top of the first layer that allows each layer to be viewed individually, or the entire drawing as a whole.
Construct **charts and tables.**	Discuss chart types and chart vocabulary. Using workplace or sample data from the class, construct tables and charts.

	For a daily example, consult *USA Today* online and look for the snapshots section that shows a graph of some sort. Ask weekly bonus questions about the data. Challenge students to bring in examples of charts and graphs containing errors.

ACADEMIC STANDARDS FOR SCIENCE

Strategies for Reinforcement in the Career and Technical Classroom

Note:
*** indicates industry-related materials, handouts, notes, etc.**

Topics Listing

General Science-	topics not specific to a content area
Physical Science-	Mechanics and Physics
	Energy and Waves
	Thermodynamics
	Electromagnetism
	Chemistry
	Optics
Life Science-	Cell biology
	Evolution
	Genetics and Heredity
	Human and Animal Development
Anatomy	Ecology
	Viruses
	Bacteria
	Plants
Earth Science-	Earth in space
	Solar System/Astronomy
	Atmosphere and weather
	Oceans and water
	Earth resources

Note:
*** indicates industry-related materials, handouts, notes, etc.**

Objective	**Classroom Applications to Industry**
GENERAL SCIENCE	
Present, *Review and Discuss,* *Master* **the list of skills employers want for the workplace regarding science skills.**	Use the list of skills employers want to introduce students to the requirements of the workplace. Depending on students' ability levels, any of the following methods may be used to increase their understanding of the concepts: • Discussion • Interviewing parents or other adults in the workplace about the skills required • Interviewing employers about the skills in terms of importance • Identifying workplace situations in which certain skills become more important than others • Researching adult education programs to learn why deficits in these areas must be remediated; find out the cost to employers to educate adult workers • Researching the topic of adult literacy
Perform **computations as required to solve problems.**	Use the metric system to convert units of measure. Round numbers to correct number of significant figures. Determine percentage of error. Understand validity, reliability, accuracy, and precision.
Apply **scientific method of inquiry.**	Identify the steps of the scientific method. Conduct experiments. Understand the following terminology: Conclusions vs inferences Variables Replications Samples/sample size

Investigate **science history as it applies to industry.**	In groups, research topics in science pertaining to your industry. Have students assign roles for each member of the group. Present findings in report format, or in oral presentations. Investigate science ethics. Recognize the processes available for accountability in industry. For example, OSHA has a Safety and Health Program Assessment Worksheet whereby employers can be rated for safety issues. See http://www.osha.gov/SLTC/safetyhealth_ecat/mod3.htm [Note: Safety and Health is a mandatory subject of bargaining when a workplace is unionized; in both unionized and non-unionized workplaces, an employer cannot create and dominate workplace safety committees (see the National Labor Relations Act).]
Use **scientific instruments to *measure* aspects of the environment.**	Gather data on time, length, mass, pressure, volume, acceleration or other measureables using instruments from the job.
Demonstrate **an understanding of data.**	List the processes involved in gathering data. Suggest ways that data can be grouped or organized. Collect specimens. Show how data can be represented (graphically, charts and diagrams, etc) Construct a model to depict a basic concept.
Identify **the seven basic S I (Systeme International) units.**	Length- meter- m Mass- kilogram- kg Time- second- s Electric current- ampere- A

	Temperature- Kelvin- K Amount of substance- mole- mol Luminous intensity- candela- cd Dictionary of units- see http://www.ex.ac.uk/cimt/dictunit/dictunit.htm
Identify **S I (Systeme International) Derived units.**	Choose units appropriate to your industry (hertz, ohm, volt, watt, etc). Create a picture dictionary demonstrating the concepts.
Review **relevant theories, laws and models**.	As relating to your industry, discuss important theories, laws and models.
Use **reference tools to solve problems.**	Use scientific reference tools (such as the Periodic Table of Elements) to learn more about specific industry concepts.
Practice **safe lab procedures.**	Handle equipment with care. Demonstrate safety and first aid procedures. Identify harmful substances.
PHYSICAL SCIENCE	
Understand **the cyclical nature of systems.**	Show, demonstrate, model, track the cycles of any of the following systems: Growth and decay Food webs Weather Water
Analyze/classify **matter according to type.**	Identify types of matter (solids, liquids, gases). Which types are predominantly used in your area of industry?
Explain **the concepts of work and power.**	Identify machines used in industry. Identify how energy levels change when work or power is increased/decreased. Identify fuel sources used in your industry. Discuss internal and external combustion.

	Create a model demonstrating the uses of levers and pulleys.
Be familiar **with concepts of motion.**	Measure acceleration and deceleration Understand the relationship between speed and velocity by performing experiments. Recognize waves and vibrations as a type of motion. Understand action and reaction. Review laws pertaining to motion.
Understand **concepts related to force**.	Show the need for balance of forces acting on an object. Observe centrifugal and centripetal forces in action. Show how friction is created and must be accounted for in using and preserving equipment. Create a chart showing types of lubricants needed in a factory and schedule of maintenance. Understand, at a level of complexity appropriate to your industry and to students' ability levels, basic principles of inertia. Show the relationship between pressure, mass, and weight.
Understand and *apply* **principles relating to the atom.**	Understand that atoms have a positive, negative or neutral charge. (Classify protons, electrons, and neutrons.) Identify ions.
Investigate **forms of and changes in energy.**	Discuss how energy is measured. Observe changes in energy relationships. Identify catalysts and reactants.

	Identify sources of kinetic and potential energy in your industry.
Discuss, apply **principles of electricity and electric currents.**	Identify types of circuits and switches. Show the difference between direct and alternating currents. Give examples of the best/most efficient use of each. Determine how electricity is measured, and solve problems using these terms. (Example, use Ohm's law to calculate current, resistance, and voltage.) Identify good conductors and insulators, and how to choose them. Understand grounding and create a visual display of grounding safety practices. Include the threat of static electricity. Show the uses of a vacuum tube by building a model. Compare the following ways of generating electricity: Hydroelectricity Motors Solar Power Steam/nuclear Transformers Incandescent (Light) Show the implications for your industry. As appropriate to your industry, identify electrochemical energy sources (cells, electrodes, batteries) and the processes of oxidation and reduction.
Be familiar **with sound waves.**	Compare how sound waves travel between liquids, solids, and air. Examine different types (lengths) of sound waves. Examine decibels safe for human hearing. Identify safety precautions for industry regarding sound tolerance.

	Be able to use correctly the terms below as they relate to your industry. (For example, ask students to write a short essay explaining a demonstration from class and include the following terms): Amplification Audible range Frequency Acoustics Resonance Speed
Be familiar **with principles of heat.**	Differentiate between the 3 types of heat transfer (conduction, convection, radiation). Understand that substances expand and contract due to heating and cooling Identify purpose and types of insulations used. Differentiate between heat and temperature.
Investigate **and** *apply* **concepts relating to temperature.**	Use the temperature scales; convert between Celsius and Fahrenheit.
Explain **the concepts of magnetism.**	Understand that currents create magnetic fields. Identify materials that are good conductors, and the properties that make them such. Understand electromagnetic forces present in earth.
Investigate/apply **chemical properties.**	Differentiate between acids and bases. Find pH for substances used in industry. Identify substances used in your industry and classify them by type. Name the major drugs, fertilizers, or additives used in your industry. Define and state examples of chemical reactions. Be familiar with solutions used in your industry. Compare saturated and unsaturated solutions. Determine whether a solution is soluble or insoluble.

	Explain solute and solvent.
Investigate **forms of and changes in matter.**	Compare and contrast physical and chemical changes. Discuss the types of physical or chemical changes that take place in your industry, from processing raw materials to manufacturing.
Understand **and apply concepts relating to the elements.**	Examine the 4 elements that make up 99% of living organisms (Hydrogen (H), Oxygen (O), Nitrogen (N), and Carbon (C)). Element Groups: Alkali Metals Alkaline Earth Metals Transition Metals Other Metals Metalloids Non-Metals Halogens Noble Gases Rare Earth Elements
Be familiar **with principles of light.**	Discuss light as a form of energy. Describe types of lighting systems. Examine the light spectrum and note the relative smallness of visible light. Define reflection and refraction. Explain how light carries information (by lasers) and show examples of the impact on technology/industry. Identify types of lenses.
Be familiar **with principles of color.**	Diagram the main parts of the eye involved in seeing color (rods, cones). Use prisms to split light into the visible spectrum. Briefly explore color blindness. What precautions should colorblind persons take regarding workplace safety?

	Define situations in which colorblindness impacts a worker's ability to do his job.
LIFE SCIENCE	
Explain **the presence of cells as the identifier of all living organisms.**	Examine the cells of organic material used in your industry, using books, the internet, or a microscope. Recognize that cells divide or replicate to promote growth of an organism. Examine the parts of a cell. Compare the cell to a machine…how do the parts function and rely on each other? Give example of one-celled and multiple-celled organisms. Review the classification system of all organisms (Kingdom, Phylum, etc). Create a circle graph or pie chart (totaling 100%) showing the relationship (in numbers) between the groups of organisms: Bacteria Fungi Viruses Insects Plants Vertebrates Invertebrates Compare some of the cell processes (active and passive transport) to the processes in your industry.
Understand **the progress of evolution of organisms.**	Recognize how a species will adapt to better fit in its environment over time.
Explain **the role of genetics in human development.**	Understand, at a level of complexity appropriate to your industry and to students' ability levels, basic principles of heredity, including: • Half of an individual's genes are contributed by each parent • Traits that are inherited are either dominant or recessive from the parent(s)

	• Cell division by mitosis versus meiosis • Disabilities are caused either by genetic/inherited conditions (such as Down's Syndrome) or in accidents occurring after birth, such as brain damage due to a car accident or a stroke
Investigate/apply **principles of human development.**	Describe the life cycle of humans and other animals. Use the concept of human development to explain the need for understanding foundation skills in your area. (For example, children do not run before they walk.) Use this concept to explain other events that occur in a natural order in your industry.
Explore **additional concepts pertaining to humans and other animals.**	Give examples of ways organisms adapt to their environment. As relating to industry, review the concepts of: Aging Immune system Skin and Tissues Blood and hemoglobin Disease
Compare/contrast **the differences between sexual and asexual reproduction.**	Determine instances when understanding the concepts of sexual reproduction are important for your industry. Highlight the effects of unsafe working practices on unborn fetuses, or the dangers present for pregnant individuals working in industry.
Show **a general understanding of the importance of health.**	Explore the cost of lost wages and worker's compensation in the past year due to health problems. Research the most common health problems among workers (workers with safe jobs; workers with most hazards to health, etc)
Investigate **the food cycle.**	Identify food chains, food webs, food pyramids. Show how changes to the food cycle affect the

	environment and affect man. Name the food groups.
Understand **nutrition and the body's need for a diet that provides vitamins and minerals.**	Show an understanding of body systems (circulatory, nervous, digestive, etc) as they relate to industry. Identify deficient vitamins and minerals among a particular population (American workers, workers in specific environments, workers who do not go outdoors, or who always work outdoors) and the health risks associated with job types (office work, mining work, etc.)
Observe **health code/sanitation requirements.**	Research the development of health code and sanitation requirements, including OSHA. Compare/contrast workplaces of 1850, 1900, 1950, 2000 regarding health and safety. Discuss the most common workplace violations of health requirements and present in a graphic format (e.g., maps, charts). Discuss potential effects of ignoring health requirements. After identifying workplace hazards, create several plans to treat the problem. Debate the benefits of each. To avoid the threat of employers choosing ineffective means of ensuring safety on the job, locate MSDS sheets, first aid stations, personal protective equipment, worker's compensation claims offices/paperwork, etc. Using workplace materials*, locate the section on safety regulations. Ask students to rank order the items. Debate the importance of each. Determine the threat of ignoring regulations. Research which regulations are often disregarded. Explore proactive measures students can take to extend their health. Understand the importance of mental health in

	addition to physical health.
Investigate/apply **principles of anatomy and physiology.**	As relating to your industry, explore issues relating to anatomy and physiology. Skeletal system- study the bones of the arm, hand, and neck. Research carpal-tunnel syndrome. Fractures- identify the types of fractures and those most common to your line of work. Learn how to prevent falls.
Understand **basic principles of Ecology.**	Define ecology. Identify 5 major ways in which man interacts with the environment, especially as relating to your industry. Discuss the effectiveness of the media as compared to pro-science groups (such as Greenpeace) on the public's awareness of important environmental issues. Identify any areas of concern regarding waste/waste management in your industry. Show the difference between a niche, community, habitat, and ecosystem. Give examples of herbivores, carnivores, and omnivores. How does your industry use and serve each group? Understand predators' effects on food chains. Identify predators of industry. Explain the process of decomposition and decay. How does industry interfere with or interrupt these processes?
State **the differences between viruses and bacteria.**	Define viruses and bacteria. Explore viral and bacterial threats present in the workplace. How can they be prevented? How can they be treated? State the benefits of viruses and bacteria.

	Explain the recent increased resistance to drugs and antibiotics.
Understand **basic concepts relating to plants.**	Describe the interchange of oxygen and carbon dioxide between plants. Contrast to the way humans exchange oxygen and carbon dioxide. As relating to industry, review the concepts of: Fertilization Parts of plant, and functions of each Effects of temperature on plants Need for water and light Photosynthesis
EARTH SCIENCE	
Recognize **earth's position in the universe.**	As relating to your industry, identify relevant topics regarding Asteroids Comets Stars Galaxies Identify planets in the solar system. Compare and contrast earth to other planets. Create a model showing the relative size of earth within our solar system. Use mathematical relationships to make sure the scale is correct (earth is the size of ___ so the sun should be the size of ___). How do the phases of the moon and sun affect the hemispheres?
Investigate **history of the earth.**	Identify geological, chemical and other methods of determining the age of an object. Demonstrate that fossils and rocks are indicators of previous eras. As a class, create a timeline indicating the age of the earth. Include the various ages (Ice Age, etc) and the length of each. Make sure the timeline is drawn to scale.

	Assign each Age to a group and research the following: Weather Major events at beginning and end of age Organisms living during this time Factors that made the Age unique
Investigate **physical characteristics of the earth.**	Label/model the components of the earth. Understand, at a level of complexity appropriate to your industry and to students' ability levels, basic principles of gravity. Solve problems of longitude, latitude and time zones. Create a model of the ratio of land and water on earth.
Investigate **physical forces acting on the earth.**	Examine erosion and depletion of nonrenewable resources. Identify natural disasters such as hurricanes and earthquakes. Research the effects of a past disaster on a specific industry. Understand, at a level of complexity appropriate to your industry and to students' ability levels, basic principles of plate tectonics (the earth's surface is broken into large plates; movements of these plates over time causes earthquakes and other geologic activity).
Explain **the basic components of earth's rotation.**	Understand that the earth spins on its axis at an angle of 23 ½ degrees Identify the period of one complete rotation as a day; longer cycles of rotations identify the seasons. Discuss time zones.
Identify **the earth's atmosphere and its components.**	Identify the main elements in the earth's atmosphere (nitrogen and oxygen). Identify layers of the atmosphere, and the ozone layer.

	Explain concepts of air pressure.
Understand **basic principles of the solar system.**	Demonstrate how the sun strikes the earth at different angles depending on location.
Demonstrate **the relationship between climate and weather.**	Identify the factors that create weather. Show how landscape features are affected by changes in climate or weather. Identify the greenhouse effect. How does industry contribute to it? Describe the relationship between altitude and weather. Understand that changes in the weather may be seen as fronts that are put in motion by the jet stream. Identify types of precipitation. Differentiate between types of clouds. Understand the effect of winds, wind speeds, and impacts on vegetation.
Learn **and** *apply* **concepts relating to the oceans.**	Label the major oceans and seas. Determine the elements in ocean water (nearly all elements are present). Identify or draw the structural components of the ocean floor. Explain the relationship between the moon and the tides. Explore ways the ocean is used for power and business.
Investigate **principles of water.**	Identify the parts of the water cycle and the effects of the processes involved. Define water's chemical properties water is the universal solvent water has a neutral ph of 7

	chemically, water is one atom of oxygen bound to two atoms of hydrogen) Measure salinity. Which industries rely heavily on water? Define water's physical properties water is the only natural substance that exists as solid, liquid, and gas water's surface has a high density water has a high tolerance for heat (heat index) water's weight water as a coolant specific gravity
Investigate **conservation of physical and natural resources.**	As relating to your industry, discuss or debate the issues of Allocation of resources Recovering resources Best/worst methods of using resources Compare/contrast renewable and nonrenewable resources. Note the important developments in your industry regarding mineral, soil, water, and wildlife conservation. Discuss alternative sources of energy as relating to your industry.
Investigate **issues regarding scientific technology.**	As relating to your industry, discuss the uses of technology. What are the newest developments? What effects does the technology have on our society? Political system? Discuss the role of economics on technology.
Apply **science principles/laws to environmental issues.**	Discuss how mankind alters the earth and environment through use of resources and technology, pollution.

Crosswalk to SkillsUSA
Computer Engineering

Student organization information correlates to course content. Student organization activities enable students to apply and practice competencies as they master them. Computer Engineering course curriculum correlates to the SkillsUSA Computer Maintenance Technology contest. The scope of the contest is consistent with the industry standards as outlined by the Computer Technology Industry Association (CompTIA) A+ Certification examination. See Related Information Section G for a crosswalk to A+ Certification exam competencies.

Purpose

To evaluate each contestant's preparation for employment and to recognize outstanding students for excellence and professionalism in the field of computer maintenance technology.

Clothing Requirement

For men: Official SkillsUSA white polo shirt with black dress slacks, black socks and black leather shoes.

For women: Official SkillsUSA white polo shirt with black dress slacks or skirt, black socks or black or clear seamless hose and black leather shoes. To purchase the polo shirt, contact Midwest Trophy Manufacturing Co. Inc. by calling 1-800-324-5996 or order online at: http://www.mwtrophy.com/vica/index.html.

Eligibility

Open to active SkillsUSA members enrolled in programs with computer maintenance technology, electronic product servicing, or electronics technology as the occupational objectives.

Equipment and Materials

- Supplied by the technical committee:
  - All materials, schematics, and equipment required for the contest
- Supplied by the contestant:
  - Pencils

- Basic hand tools suited for computer repair and maintenance
- Anti-static wrist strap w/alligator clip end. Straps must be in proper working order
- Test equipment (digital multi-meter)
- Diagnostic software with proof of ownership such as original disk or original software license, proof of payment of shareware license fee, or proof of software released into public domain (freeware).
- One standard technical data reference book such as those that include BIOS codes, HDD parameters, etc. Books normally used as a classroom text will not be permitted.
- Virus detection software with proof of owner-ship, as described in Item e. Scope of the Contest

Scope

- The contest will be consistent with the industry standards as outlined by the Computer Technology Industry Association (CompTIA) A+ Certification Examination. Additional standards are outlined in texts like *The Complete PC Upgrade & Maintenance Guide* (Sybex) and *Upgrading and Repairing PCS* (Que). A+ Certification Objectives may be found at the following website: www.comptia.org. These are also free by request. Write to: CompTIA, 450 East 22nd St. Suite 230, Lombard, IL 60148-6158.
- The contest will consist of two major parts. The first part will be a computer-based exam of 75 to 100 questions. This exam will be representative of the A+ Certification Exam. The second part will be a series of work stations through which each contestant will rotate on a fixed time schedule to trouble-shoot both hardware and software problems. The software problems will relate to DOS and Windows operating systems. Some of the workstations will require interaction between the contestants and the judges.
- Contestants will demonstrate their ability to per-form jobs or skills selected from the following list of competencies as determined by the SkillsUSA Championships technical committee (Committee membership includes Central Missouri State University, Comptia, Heathkit Educational Systems, Learning/Concepts Inc., and Ronald A. Williams Ltd.):
    - Demonstrate proper customer interaction skills
    - Diagnose and service personal computer systems to the module level

- Diagnose and resolve software problems within the computer
- Locate and identify defective modules within the computer chassis
- Demonstrate ability to load and use appropriate-ate software
- Properly configure pins and jumpers on the motherboard for proper computer function
- Properly install, configure and demonstrate proper operation of devices within the computer cabinet (hard drives, floppy disc drives, CD-ROM drives, fax modems, etc.)

- Contestants will be provided, as required, manufacturers' documentation of the devices to be installed and/or serviced. Winners will be determined on the basis of their total scores, which include diagnostic procedures, speed, standard industry procedures, accuracy of adjustments, and correct component replacements.
- Specific penalties will be assessed for the failure to properly utilize anti-static straps at all times when in contact with the computers, and the introduction of computer viruses into the contest computers. Penalties will be assessed at one point per occurrence, and notice of infractions will be communicated to the contestant when they occur..164 *SkillsUSA Championships Technical Standards (2002–2004)*

Items Evaluated

Customer Interaction
Command Line Knowledge
Windows Knowledge
Component Configuration
Computer Upgrades
Safety Practices
Appearance
Written Test
Clothing Penalty (minus 0 to 5 percent of total points)

Note: An Oral Professional Assessment will be included. Points to be determined by national technical committee. *Sponsored by Goodheart-Willcox Publisher* 165

Arkansas's All Aspects of Industry

Defining "All Aspects"

All aspects of an industry include, with respect to a particular industry that a student is preparing to enter, planning, management, finance, technical and production skills, underlying principles of technology, labor and community issues, health and safety, and environmental issues related to that industry. Planning is examined at the level of both an individual business and the overall industry. Planning elements might include:

- Developing strategic plans — mission, vision, goals, objectives, and/or a plan of action
- Working with planning tools such as surveys, market research, and competitive analysis
- Anticipating needs for staffing and major purchases of equipment and supplies
- Developing plans for training and upgrading of staff
- Forecasting market trends
- Developing business plans for entrepreneurial ventures.

Management addresses methods typically used to manage enterprises over time within the industry, as well as methods for expanding and diversifying workers' tasks and broadening worker involvement in decisions. Key elements of management might include:

- Using an organization chart to explain how a corporate chain of command works
- Providing input for strategic plans and communicating the company's vision and mission statements
- Leading employees in carrying out strategic plans and action plans
- Evaluating employee performance
- Anticipating technology and other major purchasing needs
- Ensuring equity and access for employees
- Resolving conflicts
- Developing job descriptions and written policies/procedures
- Identifying recruitment procedures, training opportunities, methods of evaluation, and retention strategies
- Working with professional associations and community outreach efforts.

Finance examines ongoing accounting and financial decisions and different methods for raising capital to start or expand enterprises. Finance functions might include:

- Developing budgets
- Preparing financial statements
- Analyzing and managing financial transactions and records
- Implementing payroll procedures
- Determining and paying taxes
- Identifying indirect wage costs (benefits, FICA, insurance, worker's compensation)
- Making loans and granting credit to customers
- Developing graphs and charts related to company finances
- Identifying and implementing methods of sustaining profitability of a business
- Managing 401K plans
- Identifying sources of capital

Technical and Production Skills cover specific production techniques and alternative methods for organizing the production work, including methods that diversify and rotate workers' jobs. Technical and production skills that an employee should have to succeed in a business or industry might include:

- Developing and upgrading job-specific skills
- Using troubleshooting and problem-solving techniques
- Analyzing information to make decisions
- Identifying and implementing quality assurance techniques
- Employing communication skills such as writing, listening, speaking, and reading
- Participating in team efforts
- Implementing projects and new techniques
- Demonstrating basic computer skills; employing time management techniques in completing projects and assigned tasks
- Demonstrating ethical behavior and work ethic.

Underlying Principles of Technology provide an integrated study across the curriculum of the mathematical, scientific, social, and economic principles that underlie the industry's technology. Principles of technology that an employee should know might be demonstrated by:

- Exhibiting proficiency in mathematical and scientific functions related to new and emerging technologies
- Continuously upgrading job skills needed to implement new technologies
- Participating in industry certification programs
- Cross-training to enhance one's value to the organization and to enhance job promotion opportunities
- Understanding and adhering to ethical issues related to technologies.

Labor Issues examine worker rights and responsibilities, labor unions and labor history, and methods for expanding workers' roles. Labor issues might include:

- Understanding and implementing worker rights and responsibilities
- Working with labor unions
- Keeping abreast of local, state, and federal legislation affecting employee and employer rights and responsibilities
- Negotiating and settling worker disputes
- Identifying certification requirements for specific jobs
- Analyzing the impact of labor agreements on business operations.

Community Issues explore the impact of the industry on the community and the community's impact on and involvement with the industry. Concepts of business and community relations might include:

- Developing and working with community outreach projects
- Participating on advisory committees and community organizations
- Working with professional associations
- Developing and implementing public relations plans
- Participating in community service projects.

Health, Safety, and Environmental Issues examine these concepts in relation to both the workers and the larger community. Concepts related to health, safety, and the environment might include:

- Identifying and implementing federal, state, and local regulations related to the health and safety of employees
- Understanding and strictly adhering to federal, state, and local environmental regulations related to the business
- Identifying job-specific health hazards and safety issues
- Identifying and implementing basic safety and first aid training techniques for emergencies such as personal illness or injury, tornadoes, fires, nuclear accidents, floods, and incidences of employee-rage or violent behavior
- Communicating safety regulations and plans to employees

Working with selected community groups to implement safety programs.

Crosswalk to Computer Engineering Certification

Tasks/competencies taught in Arkansas Computer Engineering courses have been correlated to competencies tested by industry certification examinations. CompTIA provides A+ Certification to students who pass two examinations: the Core Hardware exam, which tests knowledge in basic computer technologies and service procedures; and the Operating System Technologies exam, which tests knowledge of the DOS/Windows operating system. The Electronics Technician Association (ETA) provides the Computer Service Technician (CST) Certification, an equivalent to the A+ Certification, to students who complete a computer service technician course and pass a test that includes key CST competencies established by ETA.

Related Course Task/Competency Certification Examination Competency

- Identify the various types of preventive maintenance products and procedures.

A+ Core Hardware: Preventive Maintenance

CST: Preventive Maintenance

- Identify issues, procedures, and products designed to protect people, hardware, and the surrounding workspace within the computer environment.

A+ Core Hardware: Preventive Maintenance

CST: Preventive Maintenance

- Describe primary responsibilities of a computer systems technician.

CST: People Relations

- Research career opportunities in Computer Engineering.
- Participate in co-curricular student organization activities.
- Identify common symptoms and problems associated with various components.

A+ Core Hardware: Diagnosing and Troubleshooting

A+ OS Technologies: Diagnosing and Troubleshooting

CST: Troubleshooting

- Demonstrate basic troubleshooting procedures.

A+ Core Hardware: Diagnosing and Troubleshooting

A+ OS Technologies: Diagnosing and Troubleshooting

CST: Troubleshooting

- Identify basic terms, concepts, and functions of system components.

A+ Core Hardware: Installation, Configuration, and Upgrading

CST: Components

- Describe the way each system component works during normal operation and during the boot process.

A+ Core Hardware: Installation, Configuration, and Upgrading

- Demonstrate basic procedures for adding and removing field-replaceable units for both desktop and portable systems.

A+ Core Hardware: Installation, Configuration, and Upgrading

CST: Computer Assembly and Disassembly

- Identify available IRQs, DMAs, and I/O addresses and procedures for device installation and configuration.

A+ Core Hardware: Installation, Configuration, and Upgrading

CST: Configuring

- Identify common peripheral ports, associated cabling, and their connectors.

A+ Core Hardware: Installation, Configuration, and Upgrading

CST: Cabling

CST: Ports

- Demonstrate procedures for installing and configuring IDE/EIDE devices.

A+ Core Hardware: Installation, Configuration, and Upgrading

CST: Cabling

- Demonstrate procedures for installing and configuring SCSI devices.

A+ Core Hardware: Installation, Configuration, and Upgrading

CST: Cabling

- Demonstrate procedures for installing and configuring peripheral devices.

A+ Core Hardware: Installation, Configuration, and Upgrading

CST: Peripherals

- Identify hardware methods of upgrading system performance, including procedures for

replacing basic subsystem components.

A+ Core Hardware: Installation, Configuration, and Upgrading

CST: Computer Assembly and Disassembly

- Identify unique components and determine criteria for their use.

A+ Core Hardware: Installation, Configuration, and Upgrading

CST: Components

- Compare popular CPU chips in terms of the basic characteristics.

A+ Core Hardware: Motherboard/Processors/Memory

CST: Components

- Identify the categories of RAM by terminology, locations, and physical characteristics.

A+ Core Hardware: Motherboard/Processors/Memory

CST: Components

- Identify the most popular types of motherboards, their components, and their architecture.

A+ Core Hardware: Motherboard/Processors/Memory

CST: Components

CST: Bus

- Identify the purpose of CMOS, its settings, and the procedures for changing its basic parameters.

A+ Core Hardware: Motherboard/Processors/Memory

CST: Components

- Compare different operating systems in terms of functions, features, and benefits.

A+ OS Technologies: OS Fundamentals

- Identify the functions, structure, and major system files used to navigate the Windows operating system.

A+ OS Technologies: OS Fundamentals

- Describe procedures for obtaining needed technical information.

CST: Troubleshooting

- Identify the basic concepts and procedures for creating, viewing, and managing files, directories, and disks.

A+ OS Technologies: OS Fundamentals

CST: File Management

- Identify the procedures for installing the operating system and bringing the software to a basic operational level.

A+ OS Technologies: Installation, Configuration, and Upgrading

CST: Computer Assembly and Disassembly

CST: DOS

- Identify steps to perform an operating system upgrade.

A+ OS Technologies: Installation, Configuration, and Upgrading

CST: Configuring

- Identify the basic system boot sequences and boot methods, including the steps to create an emergency boot disk with utilities installed.

A+ OS Technologies: Installation, Configuration, and Upgrading

CST: Computer Assembly and Disassembly

- Identify procedures for loading/adding and configuring application device drivers.

A+ OS Technologies: Installation, Configuration, and Upgrading

CST: Configuring

- Identify where to obtain software and resources related to the operating system.

CST: Troubleshooting

- Recognize and interpret the meaning of common error codes and startup messages from the boot sequence.

A+ OS Technologies: Diagnosing and Troubleshooting

CST: Troubleshooting

- Demonstrate steps to correct the problems identified by error codes and startup messages.

A+ OS Technologies: Diagnosing and Troubleshooting

CST: Troubleshooting

- Recognize common problems and determine how to resolve them.

A+ OS Technologies: Diagnosing and Troubleshooting

CST: Troubleshooting

- Identify basic networking concepts, including its operation and the ramifications of repairs on a network.

A+ Core Hardware: Basic Networking

A+ OS Technologies: Networks

CST: Networking

- Identify the functions of a network administrator.
- Identify concepts and capabilities related to the Internet and the basic procedures for setting up a system for Internet access.

A+ OS Technologies: Networks

- Identify the functions, features, and benefits of different web browsers.
- Identify basic concepts related to laser, inkjet, and dot matrix printers, including operation and components.

A+ Core Hardware: Printers

CST: Peripherals

- Demonstrate care and service techniques for common problems with primary printer types.

A+ Core Hardware: Printers

CST: Peripherals

- Identify and remove viruses, worms, bombs, and Trojan horses.

A+ OS Technologies: Diagnosing and Troubleshooting

CST: Software

CST: Preventive Maintenance

- Examine issues of computer-related business ethics.
- Examine issues of copyright ownership and infringement.
- Examine issues of computer-related privacy.
- Identify functions of a firewall. A+ OS Technologies: Networks
- Identify network security issues. A+ Core Hardware: Basic Networking

A+ OS Technologies: Networks

- Identify harassment issues involving computer use.
- Identify employer-employee issues of electronic documentation ownership.

Computer Engineering
Framework Cross Reference

Computer Diagnostics

Microcomputer Systems Technology I

Unit 1 Safety	**Duty(s): A**
Unit 2 Overview	**Duty(s): B, L**
Unit 3 Tools and Equipment	**Duty(s):**
Unit 4 System Components	**Duty(s): D, E, G, K**
Unit 7 General Diagnostic Procedures	**Duty(s): C, H**

Computer Operations

Unit 6 Systems Operations	**Duty(s): D, E, F, G, H**

Computer Networking

Microcomputer Systems Technology II

Unit 1 Overview of Local Area Networks	**Duty(s): I**
Unit 2 Network Components	**Duty(s): D**
Unit 3 Network Operations	**Duty(s): D**
Unit 4 Network Components Diagnostics	**Duty(s): D**
Unit 5 Network Operating Systems Diagnostics	**Duty(s): J**
Unit 6 VICA	**Duty(s): A,B**